

REMARKS/ARGUMENTS

Claims 1-26, 28-65 and 75-284 are pending in the instant application. Claims 85-284 have been withdrawn from consideration pursuant to a restriction requirement and a constructive election.

Restriction

The Office Action alleged the claims define the following patentably distinct inventions:

- I. Claims 1-26, 28-66 and 75-85 drawn to a power generating system and a method of operating a power generating system, classified in class 60, subclass 39.53; and
- II. Claims 86-284 drawn to an apparatus and a method of converting energy in a flow of fuel and air using a combustor, classified in class 431, subclass 4.

Claims 1-26, 28-66 and 75-85 have been examined, being held constructively elected by their prosecution in the subject patent being reissued. Claims 86-284 have been withdrawn from consideration pursuant to the restriction and constructive election.

Claim Objections

Claims 28 and 88 are objected to for minor informalities. Claim 28 depends from cancelled claim 27; and claim 88 depends upon claim 29, through claim 81. By the above amendment, the objected claims are amended as prescribed by the Examiner, i.e., claim 27 is amended to depend from claim 1, and claim 88 is amended to depend from claim 86. Favorable reconsideration and withdrawal of the objection is kindly requested.

Rejection under 35 U.S.C. § 112

Claims 1-26, 28-51 and 76 are rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement thereof. Applicant respectfully traverses the rejection, for at least the following reasons.

The Office Action states “[T]here is no independent control of the air.” (Office Action, p. 5). Applicant respectfully disagrees. Fig. 2 illustrates the control of air distribution within the combustor. However, the specification further provides:

“A combustion chamber connected to the compressor is configured for staged delivery of compressed air from the compressor to the combustion chamber. Separate fuel and liquid injection controls are used for injecting fuel and liquid water respectively into the combustion chamber as needed and where needed. The amount of compressed air, fuel and water injected the pressure of the compressed air, fuel and water injected, the temperature of the compressed air and fuel injected, and the temperature of the injected water and the point of injection into the combustor are each independently controlled. As a result, the average combustion temperature and the fuel to air ratio (F/A) can also be independently controlled.”

(Col. 4, lines 33-44)(emphasis added)

Additionally, both Figs. 1 and 4 explicitly show a connection from Combustion Control (100) to Compressor (10), which takes Ambient Air (5) and delivers compressed air (11) to the combustor. Figs. 1 and 4 also show separate controls: “Fuel Control” (30), “Air Flow Control” (27), and “Water Control” (40) in addition to “Combustion Control” (100). The explicit inclusion of “Air Flow Control” (27), distinct from “Fuel Control” (30) and “Water Control” (40) enables one of ordinary skill in the art to control the air flow distinctly from control of the fuel and control of the water delivery.

Furthermore, the disclosure also states

“The flow of the compressed air (11) is controlled by an air flow controller (27) to a combustor (25).” (Col. 6, lines 40-41)

“As mentioned above, combustion controller (100) independently controls the amount of combusted compressed air (40) from air flow control (27), fuel injection (30), and water injection control 40, so as to combust the injected fuel and substantially all the oxygen in the compressed air.” (Col. 7, lines 39-43)

“The temperature is completely controllable 50 since there are independent fuel, air and water controls.” (Col. 11, lines 50-51)

“. . . providing a very efficient source of mass and pressure and at the same time giving tremendous flexibility in terms of temperature, volume, and other factors which can be controlled independently.” (Col. 20, lines 20-23)

The Office Action also states “The amount of air (and also the pressure and temperature) and controlled by operation of the compressor and turbine which are controlled by the fuel amount.” (Office Action, p. 6) This observation applies to typical simple cycle or Brayton cycle power systems.

However, the specification discloses a hybrid Brayton Rankine cycle with at least one more degree of freedom via delivery of non-flammable liquid. Consequently, the combustor outlet temperature and pressure depends on the relative delivery of vaporizable liquid relative to fuel and/or air, not just to fuel relative to air. In addition, the compressor and turbine rotational speed also depend on the applied load.)

Furthermore, while it is known in the art to use a direct drive from one or more turbine expanders to drive a compressor, neither the present disclosure, nor the instant claims, are so limited. See, *e.g.*

“It is also contemplated that the combustor and its control system, along with a suitable compressor can be used without the power turbine solely for the generation of high temperature, high pressure steam, the generation of potable water, or the recovery of valuable inorganic materials dissolved in the water.”

(Col. 24, lines 1-12)

Accordingly, Applicant respectfully submits that air flow is not uniquely set by fuel control, but may be controlled independently from fuel and/or water delivery.

In light of this and other disclosure in the original specification, Applicant respectfully submits that the claims, and particularly the portions thereof cited in the instant rejection, are fully enabled. Favorable reconsideration and withdrawal of the rejection is kindly requested.

Claims 1-26, 28-51 and 76 are rejected under 35 U.S.C. § 112, second paragraph, as indefinite for use of the term “at least about four atmospheres” in independent claims 1, 29 and 76.

Without prejudice to the rejection or disclaimer to any subject matter of the claims, as amended above, the term “about” is stricken from independent claims 1, 29 and 76. Favorable reconsideration and withdrawal of the rejection is kindly requested.

Rejection under 35 U.S.C. § 103

Claims 1-2, 5-8, 15, 17-23, 29, 33, 41, 43-47, 51 and 77-79 are rejected under 35 U.S.C. § 103(a) as obvious over U.S. Patent No. 4,928,487 to Maslak (“Maslak”) in view of U.S. Patent No. 3,048,967 to Carr (“Carr”). Applicant respectfully traverses the rejection, for at least the following reasons.

Independent claim 1 recites

1. A power generating system comprising:
 - a compressor configured for compressing ambient air into compressed air having a pressure greater than at least about four atmospheres and an elevated temperature;
 - a combustion chamber connected to the compressor, wherein the combustor is configured to receive flow of compressed air from the compressor;
 - fuel injection means for injecting fuel into the combustion chamber;
 - liquid injection means for injecting a vaporizable non-flammable liquid into the combustion chamber;
 - a combustion controller for independently controlling the quantity, pressure and temperature of the compressed air, the fuel delivered to the fuel injection means, and the vaporizable liquid delivered to the liquid injection means so the injected fuel and at least a portion of the compressed air is combusted and the injected liquid is transformed into a vapor in the combustor to create, in the combustion chamber, a working fluid consisting of a mixture of unburned compressed air components, fuel combustion products and the vapor during combustion at a predetermined combustion temperature; and
 - a work engine coupled to and supplied with the working fluid formed in the combustion chamber.

The Office Action cites Maslak as disclosing “a power plant including a compressor (12), a combustor (18) and turbine (24), air control means (the combustor geometry provided by the air introduction lines 16 and 20). A controller (48) which independently adjusts fuel flow (58) and water flow (44) to control NOx emissions.” Applicant respectfully submits that Maslak does not teach controlling the compressor to independently control compressed air delivery as noted above.

Maslak teaches: “Water is injected into the combustion zone of a combustor within a gas turbine portion of the cogeneration system to provide a predetermined reduction in NOx compounds” (Col. 2, lines 24-27). Maslak further states “In response to its inputs, water-requirements calculator 72 applies a signal representing the total desired water injection into the

combustion zone of combustor 18 required to maintain a desired level of NOx reduction for the existing level of fuel flow on a line 74 to a water flow command module 76.” (Col. 5, line 64 – Col. 6, line 2)

Maslak makes no mention of “independent” or “independently” controlling the quantity, pressure and temperature of the compressed air. Rather, Maslak teaches control of water specific to reducing NOx emissions, not for independent control of water, nor for specific temperature control, nor control to prescribed NOx emissions. Applicant respectfully submits that Maslak does not teach independent control of either water or air, and thus does not teach independent control as recited in the present claims.

Similarly, independent claim 29 recites a method of operating a power generating system, comprising, *inter alia*, a step of “independently controlling the amount of compressed air, the amount of fuel injected, and the amount of liquid injected so as to combust the injected fuel at least a portion of the compressed air and to transform the injected liquid into a vapor”.

This deficiency of Maslak is not ameliorated by the proposed combination with Carr, even presuming there was an apparent reason to combine them. Like Maslak, Carr does not mention “independent” or “independently” controlling the quantity, pressure and temperature of the compressed air. Carr seeks to: “. . . burn more fuel without exceeding the maximum temperature limits which can be tolerated within said turbine section” (Col. 2, lines 54-59) Carr further teaches use of water or water-alcohol mixtures to reduce emissions; *e.g.*,

“The above data show the superiority of tertiary butanol-water mixture with respect to smoke density of the engine exhaust gases.” (Col. 7, lines 16-18)

Applicant respectfully submits that Carr does not teach independent control of either water or air, and thus does not teach independent control of fuel, air and non-flammable liquid as recited in independent claims 1 or 29. Thus, neither Maslak, nor Carr, nor both together, teach the control features claimed. To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). Therefore, Applicant respectfully submits that independent claims 1 and 29 are patentably distinguished.

Specifically with regard to claims 15 and 41, claim 15 recites “the pressure of the compressed air is maintained constant while the temperature of combustion and the quantity of working fluid is varied by the combustion controller by adjustment of the quantity of non-

flammable vaporizable liquid fed to one or more liquid injection means located throughout the combustion chamber.” Claim 41 recites a method step “wherein the pressure of the compressed air is maintained constant while the temperature and quantity of working fluid are varied.”

The Office Action notes “that when the gas turbine is driving a load at a constant rate the compressed air and the fuel amounts would be at a constant level and it would be obvious/inherent that the temperature control is done by varying the injected water amount.”

Applicant acknowledges that operation under constant air and constant fuel would result in the turbine “driving a load at a constant rate” with a conventional Brayton cycle. However, Applicant respectfully submits that the disclosed hybrid Brayton/Rankine “VAST” cycle operates differently. e.g., when the temperature is changed by injecting “non-flammable vaporizable liquid”, the turbine efficiency will consequently change, as described by Carnot’s law. Consequently, it is not given that the gas turbine could actually be “driving a load at a constant rate” with fuel amounts “at a constant level” under varying amounts of injected water. Furthermore, as described above, the independent claims 1 and 29 include independent air flow control. Neither claim requires a constant load, nor driving the compressor at a constant rate, nor driving the compressor by the expander, but contrary specifically provide for independent control.

Additionally, references further describes injecting water before or after the combustion, while claim 15 provides for “liquid injection means located throughout the combustion chamber.”

Consequently, applicant submits that the control for constant air pressure while varying temperature and fluid as recited in Claim 15 and 41 is not taught be the applied references, taken singly or in combination, and that claims 15 and 41 are therefore patentably distinguished.

In addition to the foregoing, all of Claims 2, 5-8, 15, 17-23, 33, 41, 43-47, 51 and 77-79 each depend, either directly or indirectly from one of independent claims 1 or 29. These dependent claims are each separately patentable, but in the interest of brevity, they are offered as patentable for at least the same reasons as their respective underlying independent base claims, the features of which are incorporated by reference. Therefore, favorable reconsideration and withdrawal of the rejection is kindly requested.

Claims 3, 4 and 31 are rejected under 35 U.S.C. § 103(a) as obvious over Maslak in view of Carr as applied to claims 1 and 29, and further in view of U.S. Patent No. 2,469,679 to Wyman (“Wyman”). Applicant respectfully traverses the rejection, for at least the following reasons.

The Office Action states “As set forth above Maslak discloses the invention substantially as claimed but does not disclose a condenser in the turbine exhaust. Wyman discloses a gas turbine having a water injection (54) in the combustor and having a condenser (61,62,63,64) in the turbine exhaust.” (Office Action, p. 8)

Applicant respectfully submits that Maslak and Carr do not disclose the invention substantially as claimed. Moreover, even presuming that Wyman teaches the noted features, and that there is an apparent reason for one of ordinary skill in the art to combine the references as proposed in the Office Action, Wyman does not offer any teaching or suggestion to ameliorate the deficiencies of Maslak and Carr with respect to independent claims 1 and 29 discussed above. Wyman does not teach or suggest, *inter alia*, independent control of the amount of compressed air, the amount of fuel injected, and the amount of liquid injected so as to combust the injected fuel at least a portion of the compressed air and to transform the injected liquid into a vapor. Consequently, claims 3, 4 and 31 are patentably distinguished for at least the same reasons as their underlying independent base claims, notwithstanding the addition of Wyman. Therefore, favorable reconsideration and withdrawal of the rejection is kindly requested.

Claims 16, 24, 30, 42, 81 and 83-84 are rejected under 35 U.S.C. § 103(a) as obvious over Maslak in view of Carr as applied to claims 1 and 29, and further in view of U.S. Patent No. 4,094,142 to Pfefferle (“Pfefferle”). Applicant respectfully traverses the rejection, for at least the following reasons.

The Office Action states “At the time of invention it would have been obvious to one of ordinary skill in the art to use the fuel and fuel control and conditions set forth in Pfefferle in the Maslak system as a well known combustion arrangement and method which will reduce NOx.”

As already discussed above, Applicant respectfully submits that Maslak does not disclose the invention substantially as claimed. Furthermore, Applicant respectfully submits that Carr does not teach independent control of either water or air, and thus does not teach independent control of fuel, air and non-flammable liquid as recited in the instant claims.

Moreover, Applicant finds Pfefferle to teach: “. . . the amount of fuel charged to the combustion zone is varied in response to the power demand on the turbine. The fuel-to-air volume ratio is adjusted taking into account the temperature of the gas entering the combustion zone, so that the combustion temperature or theoretical adiabatic flame temperature of the mixture remains about constant over a wide range of fuel inputs. The effluent from the combustion zone is combined in a secondary zone with at least a portion and preferably most of the remaining compressed air charged to the turbine system.” (Col. 3, lines 6-14) Since Pfefferle teaches fuel control based on power demand and controlling the combustion temperature by the fuel/air ratio, the combustion temperature must be controlled by air control to achieve the fuel/air ratio to obtain the prescribed combustion temperature. Then the turbine inlet temperature is controlled by subsequent dilution with air.

By contrast, instant claim 1 recites “. . . a combustion controller for independently controlling the quantity, pressure and temperature of the compressed air, the fuel delivered to the fuel injection means, and the vaporizable liquid delivered to the liquid injection means”. Claim 29 recites “. . . independently controlling the amount of compressed air, the amount of fuel injected, and the amount of liquid injected”. Pfefferle's requirement of controlling the fuel/air ratio in the combustor to control temperature excludes the ability to “independently” control fuel and air.

On the other hand, Maslak teaches delivery of water/steam to achieve a prescribed reduction in NOx. When combined with Pfefferle's requirement of controlling fuel/air ratio to control temperature, Maslak's requirement for delivery of water and steam to achieve a prescribed reduction in NOx would result in the water and steam delivery to be explicitly constrained to Pfefferle's fuel/air ratio-combustion temperature requirement. Consequently, Maslak in light of Pfefferle does not appear to teach Applicant's claimed system nor method, including “independent” control of the amount of compressed air, the amount of fuel injected, and the amount of liquid injected.

Furthermore, Applicant submits that Pfefferle's method of combustion using a constant fuel/air ratio followed by dilution would result in systemically high NOx emissions of at least an order of magnitude greater than the Applicant's methods. This is at odds with the stated goals of Maslak, namely NOx reduction, and would lead an artisan of ordinary skill away from their combination. A prior art reference must be considered in its entirety, *i.e.*, as a whole, including

portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983).

Therefore, applicant respectfully submits that claims 16, 24, 30, 42, 81 and 83-84 are patentably distinguished over Maslak, Carr and Pfefferle, taken singly or in any combination, and kindly requests favorable reconsideration and withdrawal of the rejection.

Claim 82 is rejected under 35 U.S.C. § 103(a) as obvious over Maslak in view of Carr as applied to claim 1, and further in view of U.S. Patent No. 4,733,527 to Kidd (“Kidd”). Applicant respectfully traverses the rejection, for at least the following reasons.

As laid out above, Applicant submits that the claim 1 is non-obvious over Maslak in view of Carr. To this proposed combination, Kidd teaches: “The present invention relates to a system for estimating the desired water/fuel ratio to provide a substantially constant NO_x emission as a function of corrected turbine speed, inlet air temperature, load and the amount of fuel being consumed as determined by the fuel metering valve position.” (Col. 1, lined 54-59) Therefore, Kidd teaches calculation of a water to fuel ratio (WFR) and then of controlling the water delivery to achieve that water to fuel ratio. However, Kidd makes no reference to “independent”, or “independently”. Kidd only appears to mention “control” relating to controlling water flow relative to fuel flow. While accounting for the temperature of the inlet air, Kidd does not appear to refer to controlling the air or to independent control of the air flow. Applicant consequently submits that the addition of Kidd does not ameliorate the previously noted deficiencies of Maslak and Carr with respect to underlying independent claim 1. Therefore, claim 82 is not obvious over Kidd, taken singly or in any combination with the teachings of Maslak and Carr. Applicant respectfully submits that claim 82 is patentably distinguished, and kindly requests favorable reconsideration and withdrawal of the rejection.

Rejection under 35 U.S.C. § 251

Claims 52-61, 64-66, 75 and 86-284 are rejected under 35 USC § 251 as being broadened in a reissue application filed outside the two-year statutory period. Applicant respectfully traverses the rejection.

Applicant agrees with the assessment of the issue date of the subject patent under reissue, and also with the filing date of the instant reissue application. However, under admittedly

unusual circumstances, the USPTO was closed on both September 18, 2003 and September 19, 2003, along with all Federal Government Offices in the Washington, D.C. metropolitan area, due to adverse weather conditions (Hurricane Isabela). Accordingly, the USPTO issued notice that it considered Thursday, September 18, 2003, and Friday, September 19, 2003, “[A] ‘Federal holiday within the District of Columbia’ under 35 U.S.C. 21 and 37 C.F.R. 1.6, 1.7, 1.9, 2.2(d), 2.195, and 2.196. Any action or fee due on Thursday, September 18, 2003, or Friday, September 19, 2003, will be considered as timely... if the action is taken, or the fee is paid, on the next succeeding business day on which the USPTO was open, that is, Monday, September 22, 2003.” See, Notices, Official Gazette, 21 Oct 2003. Therefore, Applicant respectfully submits that the subject claims are properly considered as timely filed within the two-year statutory period, and therefore not barred. Favorable reconsideration and withdrawal of the rejection is kindly requested.

Applicant respectfully disagrees with the Office Action’s assessment of the propriety of claims 86-284, however kindly requests that the matter be held in abeyance, for example pending prosecution of a divisional reissue application, in light of their restriction and withdrawal from consideration in the present application.

The Office Action objects to the reissue declaration as defective, because the declaration cited as an error the failure to claim the broader claims to which applicant is entitled, wherein the claims constructively elected and examined were not broadened by the preliminary amendment. Applicant respectfully traverses.

“Where more than one error is specified in the oath/declaration and some of the designated “errors” are found to not be “errors” under 35 U.S.C. 251, any remaining error which is an error under 35 U.S.C. 251 will still support the reissue.” MPEP, 8th Ed., Rev. 6 (Sept. 2007), § 1414¹. In this case, notwithstanding that independent claims 1 and 29 claims are not broadened, independent claim 52, *inter alia*, includes broadening amendments which were not rejected over any prior art. Applicant submits that the undue limitation of the scope of claim 52

¹ “The MPEP states that it is a reference work on patent practices and procedures and does not have the force of law, but it “has been held to describe procedures on which the public can rely.” *Patlex [Corp. v. Mossinghoff*, 758 F.2d 594, 225 USPQ 243, (Fed. Cir. 1985)], 758 F.2d at 606, 225 USPQ at 252 (citing *In re Kaghan*, 387 F.2d 398, 401, 156 USPQ 130, 132 (CCPA 1967))” *Ethicon Inc. v. Quigg*, 849 F.2d 1422, 7 USPQ2d 1152 (Fed. Cir. 1988)

at least is an error correctable by the instant reissue application, and supports the reissue notwithstanding that claims 1 and 29 are not amended.

Claims 1-26, 28-51 and 76 are rejected under 35 U.S.C. § 251 as being based upon a defective reissue application. Applicant respectfully traverses.

Applicant respectfully submits that the objection to the reissue declaration have been obviated, perhaps most notably in light of curing the rejection of broadened claims 52-61, 64-66, 75 and 86-284 under 35 U.S.C. § 251, above. Favorable reconsideration and withdrawal of the rejection is kindly requested.

Conclusion

In light of the foregoing, Applicant respectfully submits that all pending claims are patentable, and kindly solicits an early and favorable Notice of Allowability. If the Examiner has any reservation in allowing the claims, and believes that a telephone interview would advance prosecution, he is kindly requested to telephone the undersigned at his earliest convenience.

THIS CORRESPONDENCE IS BEING
SUBMITTED ELECTRONICALLY
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Respectfully submitted,



David J. Torrente
Registration No. 49,099
OSTROLENK, FABER, GERB & SOFFEN, LLP
1180 Avenue of the Americas
New York, New York 10036-8403
Telephone: (212) 382-0700

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